accompanied by a box of apparatus, simple and cheap, to enable the object-lessons to be properly illustrated. Loan collections of models illustrative of mechanics, physiology, and botany, will also be provided; but as far as possible the children are to be encouraged to bring familiar objects, and to make their own models and apparatus. After giving very full directions for the teaching of the infants and the first standard children, which we need not insert in detail, the course prescribed for the upper classes is as follows:—

Standards II. and III.

As the aim in these standards is to lead up to the specific subjects of the Code, the teaching must be more advanced, and should make a larger demand on the thinking powers of the children.

The objects contained in the previous groups should be again employed, but fresh ones should be occasionally introduced, especially for the purpose of comparison.

In the animal group children should be led to compare and classify the different animals, and to notice the chief differences and resemblances between the leading divisions of the animal kingdom. The children should also have explained to them the preparation, qualities, and uses of animal substances employed in the arts, such as leather, silk, wool, and horn.

In the vegetable group such distinctions as that of endogen and exogen should be made clear; the gradual growth of plants such as beans and wheat should be traced; the uses of vegetable substances, such as cotton, linen, starch, sugar, coffee, tea, and india-rubber, with the processes of manufacture, should be explained.

In the mineral group attention should be called to the general properties of metals, iron, copper, silver, gold, lead, tin, zinc, mercury, &c., and the qualities peculiar to each. The iron and steel manufactures, and the making of bricks, pottery, earthenware, &c., may be explained; and the distillation of coal and manufacture of gas, may be experimentally illustrated.

The knowledge of the points of the compass, and form and motions of the earth, which is required by the Code, will naturally be imparted by means of object lessons.

This object teaching may be connected, as occasion offers, with the lessons in geography, and may often be made to illustrate the reading and dictation lessons.

The teacher is not expected to attempt to teach all the subjects mentioned in the preceding paragraphs, nor to limit himself to them, but the Inspector will inquire what particular course the object lessons have taken, and will frame his examination accordingly, taking care that the fundamental facts connected with matter and force are not overlooked.

Standards IV. to VI.

Though in the higher standards one or more of the scientific specific subjects of the Code is expected to be taken, it will be generally found necessary to continue some of the training just described. Thus, in the Fourth Standard, lessons on the principles which are at the foundation of all physical, mechanical, and chemical science should be given; during which clear ideas should be imparted as to size, weight, and specific gravity, as to the laws of motion of solids, liquids, and gaseous bodies, as to the production, radiation, conduction, and absorption of heat, and as to the difference between chemical combination and the mere mixture of the constituents. Occasional lessons also on the atmosphere and its composition, and the ordinary meteorological changes should be given, and local phenomena of springs, streams, hills, ponds, excavations of the soil, &c., should be observed. Boys as well as girls should be taught something of the laws of health. Domestic economy should not be taught empirically, but the scientific principles involved in the lighting of a fire, in cooking, in the choice of clothing material, in washing, and in ventilation, should be experimentally explained.

The foundations of a "knowledge of common things," as Dr. Lyon Playfair happily called it, will thus be well laid; and the children of the London schools will at an early age acquire the habit of correct observation—no mean advantage whatever may be their future occupation in life. This additional course of instruction will not occupy more than about two hours a week, and will involve scarcely any extra expense, while it will sharpen the wits of the children and freshen their minds for their more literary studies.

NOAD'S "ELECTRICITY"

The Student's Text-Book of Electricity. By H. M. Noad, Ph.D., &c. A new edition, carefully revised, with an Introduction and Additional Chapters by W. H. Preece, M.I.C.E., &c. (London: Crosby Lockwood and Co., 1879.)

IN his introductory note to this new edition of the "Student's Text-Book of Electricity," Mr. Preece informs us that the revision is only partially his own, having been begun by Dr. Noad shortly before his lamented decease. In fact a large portion of the work appears to be reprinted from former stereotyped plates.

In addition to a large number of illustrative cuts, the work possesses a very valuable feature, too rare in elementary books, namely, frequent references to important original memoirs. A judicious use is made of extracts, as, for example, from the lectures of Prof. Fleeming Jenkin on submarine telegraphy, and from those of Sir W. Thomson on atmospheric electricity and terrestrial magnetism. New chapters on telephones, duplex and quadruplex telegraphy, and on the electric light, bring up the scientific information to the present year. As an elementary treatise on the purely phenomenal side of the science of electricity, it is probably the fullest text-book in the language.

Having said this, our commendations must end. Mr. Preece's opening paragraph bears the stamp of being an excuse for the shortcomings of the work; and we must regard it as his misfortune, rather than his fault, if a book which he has had to revise fall far short of what it might have been had it been produced under his sole responsibility. It is unfortunately—in science, at least—the reviewer's duty to be candid on the shortcomings of the work under his notice; and the only way to prevent the repetition of erroneous statements, and to secure their effective correction, is to point them out fearlessly. We are bound, therefore, to undertake the ungracious task of indicating sundry blemishes which it is to be hoped will not be perpetuated in another edition.

There appear to be several discrepancies between the earlier and the later parts of the book. On p. 178 mention is made of "a battery known as the *Pile Marie Davy*," in which *sulphate of mercury* is used; and which is stated to be *weaker* than Daniell's cell, but to have *been used to some extent in France*. On p. 434 appears an account of the "*Marié-Davy Battery*," which "has been *much used in England, and is largely employed in France and on the Continent*." It is twice stated to contain *bisulphide of mercury*; and lower down on the same page it is declared on the authority of Latimer Clark to have an electromotive force of 76, as compared with 56 for a Daniell's cell.

The divided ring electrometer of Sir W. Thomson is described on p. 79. Another description and a figure of the instrument are given on p. 529. The quadrant electrometer, of which there is no mention in the early chapter where Peltier's and other electrometers are given, is described at some length and figured on p. 537.

In a couple of pages devoted to the "Insufficiency of the Contact Theory" of voltaic electricity, the authorities cited are Faraday, Roget, and "lastly," Sir W. Snow Harris; the later fundamentally important researches of Hankel, Thomson, Kohlrausch, and Clifton, being absolutely ignored.

Two pages (22 and 23) are devoted to Varley's multiplier, but there is not a word about the earlier invention of Nicholson, nor the more recent "replenisher" of Sir W. Thomson. Nor is there a single word about the Holtz machine.

In magnetism there is no attempt to explain the meaning of the term "declination," and the word "variation" is made to do duty both for declination and for the variation of declination, in a manner most perplexing to the uninitiated in electrical terms. And yet the book is avowedly "written under the idea" that the student "approaches the subject from the datum line of ignorance!"

We cannot accept without protest the following statement:—

"The fall of tension is always accompanied by its conversion into heat" (p. 198). Nor this: "With sulphuric acid the iöns (*sic*) are H and SO_4 (Sulphionide of Hydrogen)."

The term the "*absolute quantity of electric force in matter*," used on p. 223, is open to serious objection. On p. 209 we read that "the common non-absolute unit of work involving the product of a weight into a length is styled *kilogramme*, or foot-pound."

The following statement:—"we have, calling C the charge, Q the quantity, and S the surface, $C = \frac{Q^2}{S^2}$," appears on p. 61. After pondering over this formula, we give it up.

We are compelled to take exception to the following manner of stating the well-known law of Ohm:—"Thus let F denote the actual force of the current, that is, its power to produce *heat*, magnetism, chemical action, *or any of its other effects*; E the electromotive force, and R the resistance of the wires and liquids, then $F = \frac{E}{R}$" (p. 199). To say nothing of the assumption that all the "effects" of the current are simply proportional to the current strength, we protest against the introduction of that much-abused word, *force*, where every other treatise on electricity in the language has put "strength" of current or "quantity" of current or "intensity" of current. On p. 209 the formula again appears, this time as $C = \frac{E}{R}$, which is the form adopted by Maxwell, Jenkin, Culley, Foster, Chrystal, the British Association Committee, and in the well-known treatises of Ganot and Deschanel. Guthrie uses $Q = \frac{E}{R}$, and the form $I = \frac{E}{R}$ is used by Maxwell, Cumming, Clark and Sabine, Verdet, Daguin, Wiedemann, Jamin, and continental writers generally. It is very desirable that needless departures from one or other of the established forms should be discouraged. The "Return Charge" of the Leyden jar, so-called on p. 46, is now almost universally denominated the "residual" charge, a term which is far preferable, as it cannot be confounded with the return shock or return stroke, or "back stroke," as it is termed on p. 91.

In the chapter on the telephone occurs the following passage:—"In 1874 Mr. Elisha Gray, of Chicago, America, succeeded in effecting the transmission, through a wire, by means of electricity, of the variable intensity, as well as the pitch of a sound. Subsequently he invented a form of telephone by which all the three characteristics of sound could be transmitted. *As a result, the electrical transmission of articulate speech became an accomplished fact.* It remained, however, for Prof. Graham Bell, of the Boston University, to accomplish this latter feat in the most effective manner." Do we understand Mr. Preece to endorse Elisha Gray's claims to precede Bell as the inventor of an *articulating* telephone? As a minor blemish, we notice the name of Philip Reis appears as Reiss. Many persons confound the inventor of the original singing telephone with Peter Riess the author of the *Reibungselectricität*; and the misspelling of his name helps to perpetuate the error. One other quotation from the editorial add tions is not devoid of interest:—

"The subdivision of the (electric) light has recently occupied the attention of inventors. Jablochkoff works four lamps simultaneously. Wallace has worked ten. Attempts have been made to do this on a much larger scale by raising platinum and iridium to incandescence, or to that temperature just below melting-point. A soft and gentle light is thus obtained. But the result has not been commercially successful, *though probably this is the direction in which ultimate success will be obtained*" (p. 576).

We wish heartily that the editor of this new edition had himself re-written the work; a reviewer's task would then have been much more agreeable.

SILVANUS P. THOMPSON

LENZ'S SKETCHES FROM WEST AFRICA

Skizzen aus Westafrika. Selbsterlebnisse von Dr. Oscar Lenz. (Berlin: Hofmann and Co., 1878.)

DR. LENZ'S "Sketches from Western Africa" are unusually interesting and instructive. They are not descriptions of travel in the ordinary sense of the word, but form a collection of essays, perfectly independent of each other, describing in a masterly manner the natural and social conditions of that scantily investigated coast, as they presented themselves to the eminent